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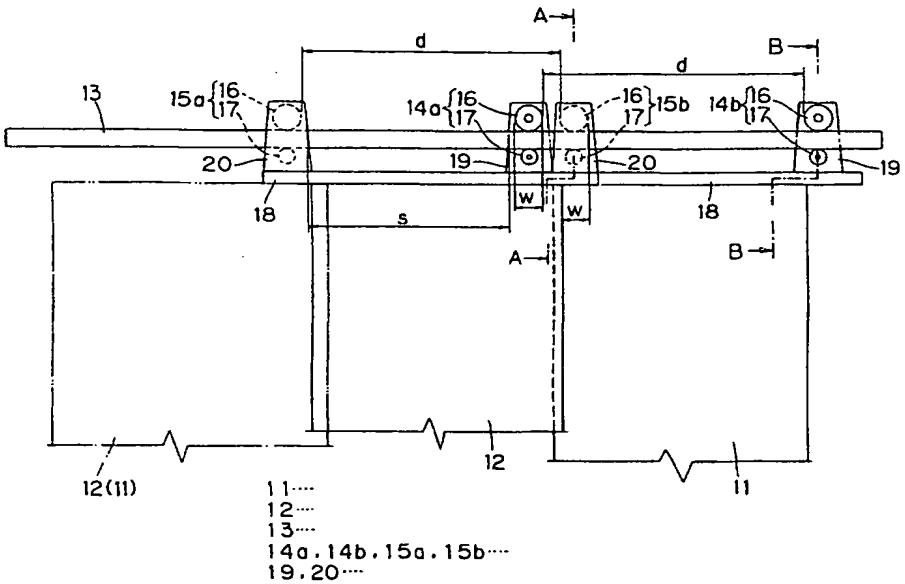
(54) Title: MULTIPLE STAGE OPENING/CLOSING DOOR FOR ELEVATOR



(57) Abstract: One rolling unit (14a) associated with each door section (11) is arranged between the rolling unit pair (15a and 15b) associated with the adjacent door section (12). The distance d between each given rolling unit pair (15a and 15b) associated with the adjacent door section (12) is set to be greater than the width w of the rolling unit associated with the adjacent door section (11), which is arranged between the aforementioned given rolling unit pair, plus the relative stroke s of the adjacent door section (11). One rolling unit (15b) associated with each door section (12) rolls on common guide rail (13) between the rolling unit pair (14a and 14b) associated with the other door section (11).

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MULTIPLE STAGE OPENING/CLOSING DOOR FOR ELEVATOR

Field of the Invention

The present invention relates to a multiple stage opening/closing elevator door which is a door arranged on the elevator car side or the passenger boarding side of the elevator and opens and closes the door opening part in multiple stages in the lateral opening direction.

Background

Doors for elevators include those arranged in two overlapping door sections on one side of the door opening that can be opened and closed in the lateral opening direction via a drive means.

Typically, this type of conventional door has the structure shown in Figure 5 and Figure 6.

In the figures, 1 is the high-speed side door section that slides along the door opening part at high speed and 2 is the low-speed side door section that slides at about ½ at the speed of aforementioned door section 1 synchronously with high-speed side door section 1. The high-speed side door section 1 and low-speed side door section 2 are suspended from front and rear double-row door rails 3 and 4 respectively, arranged along the top side of the door opening part via a pair of rolling units 5a and 5b, and are mutually linked via double speed synchronizing mechanism 8 composed of multiple pulleys 6, etc., and rope 7. Therefore, when either high-speed side door section 1 or low-speed side door section 2 is operated to advance or retreat via an actuator (not shown in the figures) for opening/closing the door, approximately simultaneously with the arrival of high-speed side door section 1 at the target position, low-speed side door section 2 will have reached a position that is the approximate halfway point, and as a result, seamless and rapid door opening/closing is realized.

In the case of this example, rolling units 5a and 5b are constituted of main guide roller 9 which contacts the top surface side of corresponding door rails 3 and 4 and sub-guide roller 10 which contacts the bottom surface side of aforementioned rails 3 and 4.

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However, in this conventional multiple stage opening/closing type door, dedicated guide rails 3 and 4 for respectively hanging high-speed side door section 1 and low-speed side door section 2 are arranged in two stages at the front and rear, so that in addition to a complicated door support part structure which results in high manufacturing costs, there is the inconvenience of enlarging the door support part area.

Therefore, the present invention aims to provide a multiple stage opening/closing door for an elevator capable of achieving reduced manufacturing costs and making the door support part area compact by being designed so that it is possible to simplify the structure of the door support part.

Disclosure of the Invention

According to the embodiment of the present invention disclosed herein, multiple door sections are suspended from a single door rail arranged along the top side of the door opening part, and the door opening part opens and closes in the lateral opening direction by the synchronous operation of said door sections in the same direction, in that each of these door sections is suspended from the aforementioned door rail via a pair of rolling units attached to each of the aforementioned door sections with a prescribed separation in the opening/closing direction, one rolling unit of a given door section is arranged between the rolling unit pair of the adjacent door section, where the spacing between each given rolling unit pair of each door section is set to be greater than the width of the rolling unit of the adjacent door section which is disposed between the aforementioned given rolling unit pair plus the relative stroke of the adjacent door section, and the rolling units of the two adjacent door sections roll on a common door rail.

Thus, the rolling unit of a given door section rolls on the common guide rail between the rolling unit pair of the other door section. Consequently, the rolling units of adjacent door sections can roll without interfering with each other.

According to a further embodiment of the present invention, one of the two adjacent door sections is attached to its corresponding rolling units via a support plate that extends upward on the front surface side of the door rail and the other is attached to

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its corresponding rolling units via a support plate that extends upward from the rear surface side of the door rail.

In this case, the mutual interference of the support plates of the adjacent door sections can be reliably avoided without a complex structure for the support plate and the rolling unit.

Brief Description of the Drawings

Figure 1 is an elevation showing the closed state of the door in an embodiment of the present invention.

Figure 2 is a cross section along line A-A in Figure 1 showing the same embodiment.

Figure 3 is a cross section along line B-B in Figure 1 showing the same embodiment.

Figure 4 is an elevation showing the opened state of the door in the same embodiment.

Figure 5 is a front view of an example of the prior art.

Figure 6 is a top view of the door rail of the same example of the prior art.

Best Mode of Carrying Out the Invention

Next, an embodiment of the present invention will be explained based on Figures 1-4.

The multiple stage opening/closing door of this embodiment is a type of door which has two door sections accommodated in a door receptacle (not shown) on one side, one section is high-speed side door section 11, and the other is low-speed side door section 12. Figure 1 and Figure 4 are elevations that show the door of this embodiment from the inside of the elevator car and, as shown in these figures, high-speed side door section 11 is arranged so that it overlaps front surface side of low-speed side door section 12.

Elongated member 13 is the door rail arranged on the top part of the door opening part along the top side of the opening part and aforementioned door sections 11 and 12

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are suspended from this door rail 13 via a pair of rolling units 14a, 14b and 15a, 15b, respectively.

Rolling units 14a, 14b, 15a, and 15b of door sections 11 and 12 are each provided with main guide roller 16, which makes contact with the top surface of door rail 13, and sub-guide roller 17, which makes contact with the bottom surface of said door rail 13, which are respectively mounted via support plates 19 and 20 to bracket 18, which is mounted to the top end of door sections 11 and 12. Bracket 18, respectively mounted to door sections 11 and 12, has a set length which is longer than the lateral width of corresponding door sections 11 and 12; support plates 19 and 20 are mounted to bracket 18 so that distance d of rolling units 14a, 14b, and 15a, 15b supported by said support plates 19 and 20 is set to the required length (to be discussed below).

Also, rolling units 14a, 14b, 15a, and 15b and support plates 19 and 20 are formed to approximately the same shape for high-speed side door section 11 and low-speed side door section 12. Support plates 19 and 19 of high-speed side door section 11 are designed to support corresponding rolling units 14a and 14b with the plates on the front surface F side of door rail 13 from bracket 18, as shown in Figure 3. Support plates 20 and 20 of low-speed side door section 12 are designed to support corresponding rolling units 15a and 15b with the plates on the rear surface R side of door rail 13 from bracket 18, as shown in Figure 2. Thus, high-speed side door section 11 and low-speed side door section 12 are suspended on door rail 13 from opposite sides via respective support plates 19 and 20.

One rolling unit 14a and 15b of door sections 11 and 12 is arranged between two rolling units 15a, 15b, and 14a, 14b of adjacent door sections 12 and 11, so that all rolling units 14a, 14b, 15a, and 15b roll on common guide rail 13. Also, distance d of two rolling units 14a, 14b, and 15a, 15b of door sections 11 and 12 is set to be greater than rolling unit width w of adjacent door sections 12 and 11 arranged between the rolling units plus relative stroke s of both door sections 11 and 12, as shown in Figure 1.

In the case of the multiple stage opening/closing doors of this embodiment, both door sections 11 and 12 are attached according to a two-speed synchronization mechanism (not shown in the figures) composed of multiple pulleys, rope, etc., in the same manner as the prior art discussed above, and when one door section 11 or 12 is

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operated according to an external actuator, both door sections 11 and 12 operate synchronously in the same direction, so that the speed of high-speed door section 11 is about twice that of low-speed side door section 12.

This multiple stage opening/closing door is accommodated within the door receptacle so that one of the two door sections 11 and 12 more or less completely overlaps the other, as shown in Figure 4 when the door is totally opened; and at this time, one rolling unit 14a of high-speed side door section 11 is supported on door rail 13 at a position close to the other rolling unit 15a of low speed door section 12.

When power is input to one door section 12 or 11 in this state according to an actuator in the door closing direction, high-speed side door section 12 moves at approximately twice the speed of the low-speed side door section along with the operation of low-speed side door section 11 and continuously makes a transition to the completely closed state shown in Figure 1 without forming a space between the two.

At this time, one rolling unit 14a of high-speed side door section 11 rolls on guide rail 13 between two rolling units 15a and 15b of low-speed side door section 12, and one rolling unit 15b of low-speed side door section 12 likewise rolls on guide rail 13 between two rolling units 14a and 14b of high-speed side door section 11. Distance d of two rolling units 14a, 14b and 15a, 15b of door sections 11 and 12 is set to be greater than relative stroke s of low-speed side door section 12 and high-speed side door section 11 plus width w of rolling unit 14a (15b) so that rolling units 14a, 14b, 15a, and 15b do not interfere with each other.

Also, when the door is opened from this state, high-speed side door section 11 similarly moves at approximately twice the speed of low-speed side door section 12, and both door sections 11 and 12 are finally accommodated within the door receptacle approximately simultaneously. At this time, one rolling unit 14a and 15b of door sections 11 and 12 roll on door rail 13 between two rolling units 15a, 15b and 14a, 14b of adjacent door sections 12 and 11 in the same manner as during closing of the door.

Therefore, in this multiple stage opening/closing door, such inconveniences as interference between rolling units 14a and 15b, etc., do not occur, both door sections 11 and 12 can be suspended from a common door rail 13, and the door support part structure can be greatly simplified relative to the prior art, which employs multiple door rails.

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Also, support plates 19 and 20 of door sections 11 and 12 can be mounted upright on the same side (front side or the rear side) of door rail 13. If both door sections are designed to be mounted upright from different sides, as in this embodiment, all that would be necessary would be to mount rolling units 14a, 14b, 15a, and 15b in the same way for corresponding support plates 19 and 20. Consequently, interference between support plates 19 and 20 can be easily avoided without resorting to a complex design for support plates 19 and 20, rolling units 14a, 14b, 15a, and 15b, etc.

Furthermore, by forming support plates 19 and 20 of both door sections 11 and 12 so that they can be mounted upright on different sides of door rail 13, as in this embodiment, along with the ability to make the distance from the wall of support plates 19 and 20 to door rail 13 be short and approximately equal, both door sections 11 and 12 can be hung from the opposing front and rear sides by interposing door rail 13 so that there is good load distribution of both door sections 11 and 12 on door rail 13. Therefore, running of door sections 11 and 12 can be stabilized.

In the aforementioned embodiment, support plates 19, 19 and 20, 20 on both sides were formed separately. However, support plates 19, 19 and 20, 20 can be formed integrally with door sections 11 and 12, which is advantageous from the point of view of strength compared to forming support plates 19, 19 and 20, 20 as separate elements.

As described above, the invention can reduce the manufacturing cost and make the door support part area compact by simplifying the structure of the door support part since the rolling units of the adjacent door sections are composed to roll on a common door rail without interference.

In addition, the invention can reliably avoid interference between the support plates of the adjacent door sections without resorting to a complex design for the support plates or the rolling units so that the entire assembly can be made even more compact. Also, the mounting sections of the support plates for the door sections are opposite the front and rear sides of the door rail in the adjacent door sections, so that the load is well distributed over the door rail.

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What is Claimed:

Claim 1: Multiple stage opening/closing elevator door assembly characterized by the fact that multiple door sections (11,12) are suspended from a single door rail (13) arranged along the top side of a door opening and the door opening is closed in the lateral opening direction by synchronous operation of said door sections in the same direction, in that each of said door sections is suspended from said door rail via a pair of rolling units (15a, 15b, 14a, 14b) attached to each of said door sections with a prescribed separation in the opening/closing direction, wherein one rolling unit (14a) of a first door section is disposed between the rolling unit pair (15a, 15b) of another door section, where lateral spacing (d) between each rolling unit pair of the first door section is set to be greater than the width (w) of the one rolling unit of the other door section plus the relative stroke (s) of the other door section.

Claim 2: Multiple stage opening/closing elevator door assembly of Claim 1, characterized by the fact that one of the two door sections is attached to its corresponding rolling units via a support plate (19) that extends upward on a front surface side (F) of the door rail and the other door section is attached to its corresponding rolling units via a support plate (20) that extends upward from a rear surface side (R) of the door rail.

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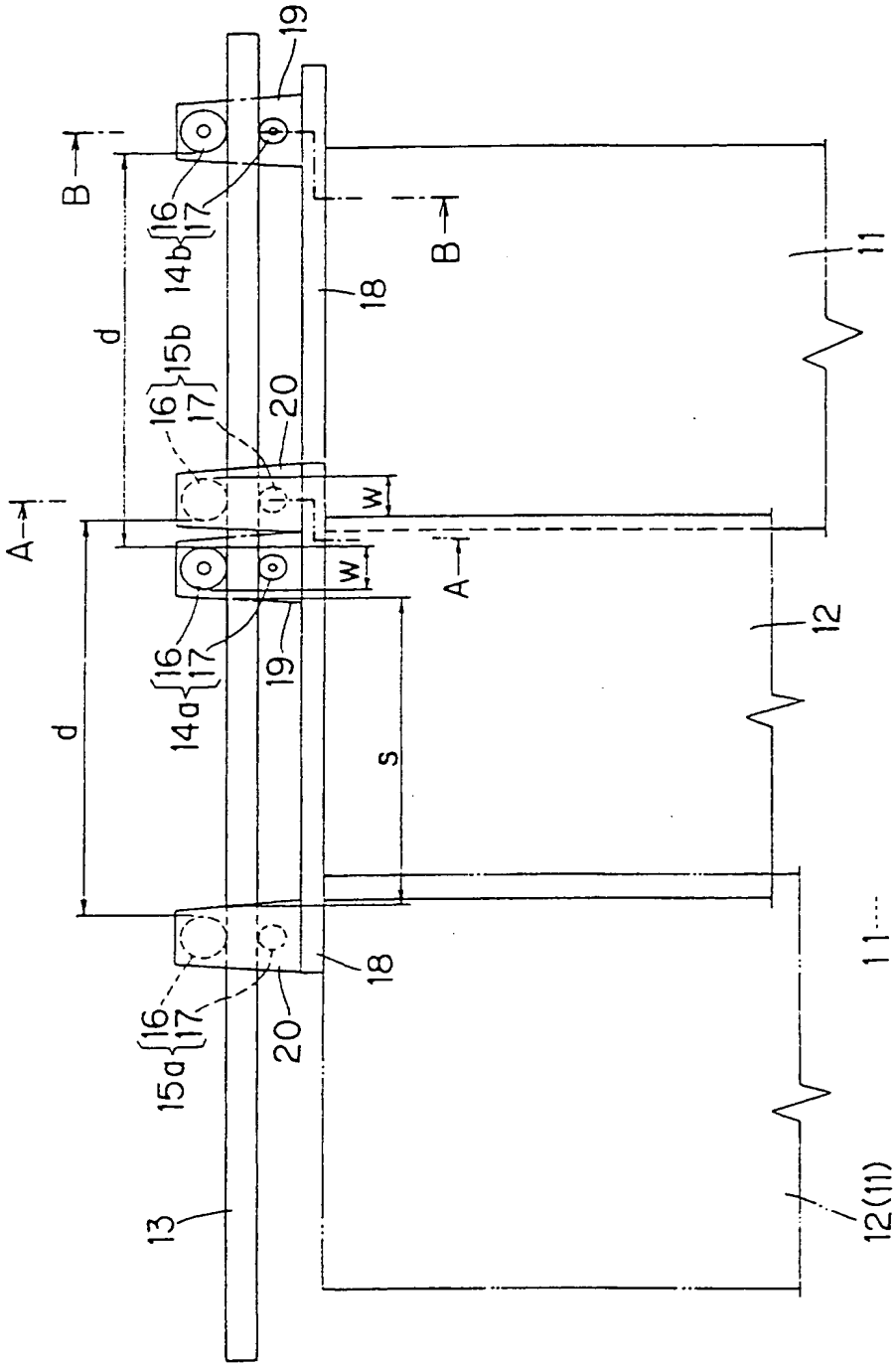

Fig. 1

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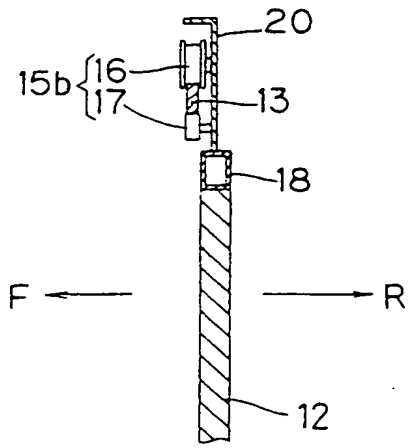

Fig. 2

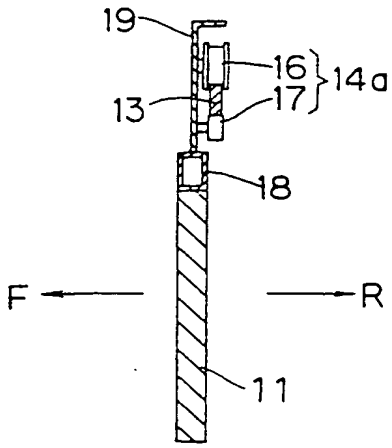

Fig. 3

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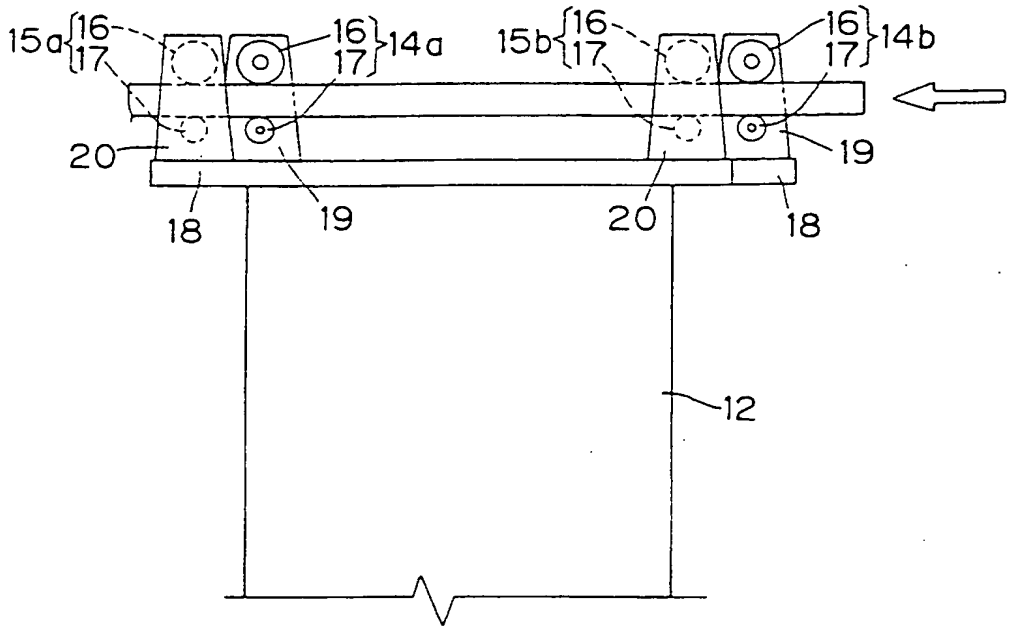

Fig. 4

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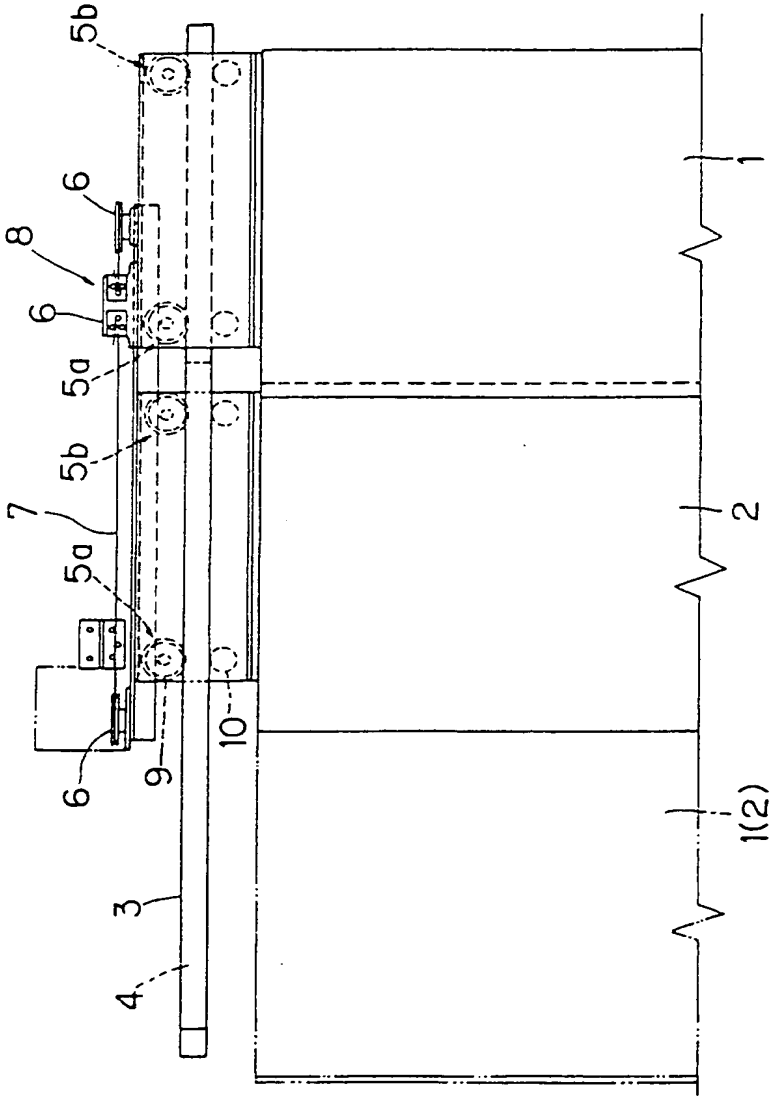

Fig 5

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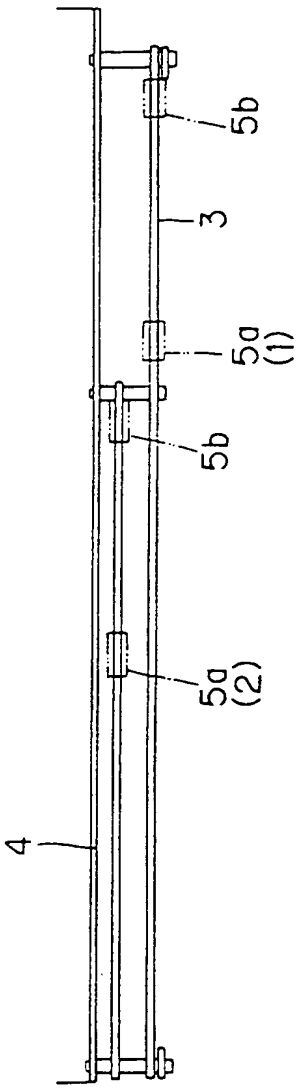

Fig. 6

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